Guidelines for the Rehabilitation of Crown Land

Occasional Paper No. 4

March, 1986

Province of British Columbia

Ministry of Lands, Parks and Housing

Land Policy Branch

86-04524/

C
2407
C
06'4
1986
c.3

Canadian Cataloguing in Publication Data

British Columbia. Land Policy Branch
Guidelines for the rehabilitation of crown land

(Occasional paper, ISSN 0827-7354 ; no. 4)

Bibliography: p.
ISBN 0-7726-0475-4

1. Reclamation of land - Government policy - British Columbia. 2. Crown lands - Government policy - British Columbia. 3. British Columbia - Public lands. I. Title. II. Series: Occasional paper (British Columbia. Land Policy Branch) ; no. 4.

HD319.B7B758 1986 354.7110082'326 C86-092087-9

PREFACE

This document contains general guidelines for the rehabilitation of Crown land in British Columbia, for the information of the general public and commercial/industrial Crown land users.

It outlines the purpose of rehabilitation activities, the importance of rehabilitation planning both during and after development, and the specific techniques used in returning Crown land to a desirable end state after development has occurred.

These guidelines complement and reinforce the provisions of the Ministry's Crown land use policies as contained in the Crown Land Administration Manual. This manual established both policies and procedures by which Crown land under the jurisdiction of the Ministry is administered in the public interest.

TABLE OF CONTENTS

		Page
	PREFACE	(i)
	TABLE OF CONTENTS	(ii)
1.0	INTRODUCTION	1
	1.1 Purpose	1
	1.2 Definitions	2
	1.3 Importance of Rehabilitation Planning	2
2.0	REHABILITATION GUIDELINES	4
	2.1 Determination of the Most Appropriate End Use	4
	2.2 Clearing and Disposal of Vegetation	6
	2.3 Removal, Storage and Disposal of Topsoil and Overburden	8
	2.4 Operational Site Maintenance and Rehabilitation	9
	2.5 Removal of Structures and Waste Materials	10
	2.6 Site Recontouring, Topdressing and Cultivation	11
	2.7 Revegetation and Fertilization	13
	2.8 Monitoring	16
3.0	SELECTED REFERENCES	17

1.0 INTRODUCTION

1.1 Purpose

The Ministry of Lands, Parks and Housing administers Crown land in accordance with the provisions of the Land Act in British Columbia. The Ministry has a responsibility to ensure that Crown land which is allocated for different purposes is both maintained and returned to the Crown in a viable condition.

The purpose of these rehabilitation guidelines is:

(a) To outline Ministry expectations to Crown land applicants and tenure holders regarding the care and rehabilitation of Crown land during and following the term of tenure.

(b) To assist Ministry regional staff in the evaluation of Crown land applications and in the development of tenure management plans.

(c) To provide a technical basis for the fulfillment of standard cleanup requirements contained in the Ministry tenure documents.

(d) To inform other government agencies of this Ministry's approach to the rehabilitation of Crown land, and to describe expectations in instances, such as quarrying, where other agencies are administering Crown land on the Ministry's behalf.

In order to accomplish the above purpose, the guidelines have been developed in a manner which is consistent with Ministry land administration policy.

1.2 Definitions

(a) "Rehabilitation" refers to any treatment of land, during and/or following its use, such that its capability and condition are:

(i) brought back as closely as possible to the state they were in prior to development; or

(ii) brought back to a condition suitable for another desirable use as approved by the Ministry.

1.3 Importance of Rehabilitation Planning

Rehabilitation planning promotes effectiveness and cost efficiency in Crown land management and rehabilitation activities. It also minimizes the overall disruption of the landscape and the environment of the area under development.

Rehabilitation planning, whether incorporated in the Quarry Reclamation Plan required by the Ministry of Energy, Mines and Petroleum Resources or in the Ministry of Lands, Parks and Housing's Management Plan, should address the following items as they are applicable to the site and the specific

type of industrial or commercial use for which the tenure has been issued:

(i) determination of the most appropriate end use;

(ii) clearing and disposal of vegetation;

(iii) removal, storage and disposal of topsoil and overburden;

(iv) operational site maintenance and rehabilitation;

(v) removal of structures and waste materials;

(vi) site recontouring, topdressing and cultivation;

(vii) revegetation and fertilization; and

(viii) monitoring.

These topics are discussed fully in Section 2.0 below. The choice of rehabilitation methods to be used is determined primarily by the intended end use of the site. A number of environmental factors, however, also influence the choice of reclamation methods for a given area. Of particular concern are climate (especially total annual precipitation, seasonal runoff rates, mean and extreme temperatures and frost free periods) and soil and substrate. Rehabilitation methods which will be most effective given the prevailing environmental conditions at the site under consideration should be selected in the course of planning.

2.0 REHABILITATION GUIDELINES

It should be noted that these guidelines have been prepared for typical commercial/industrial operations. Some modification of these approaches may be necessary where special circumstances dictate.

2.1 Determination of the Most Appropriate End Use

Rehabilitation planning should be focussed towards a particular desirable end use as approved by the Ministry. This is consistent with Ministry policies on quarrying and commercial/industrial use. Criteria which may be used by the Ministry in establishing the appropriate end use for the site include the following:

(a) Site Characteristics

Physical characteristics, including climate, substrate, location of water table, topography, aspect and elevation, as well as access and servicing, influence the types of end use which are possible on a given site. In addition, certain combinations of site characteristics may dictate one particular use as the most appropriate.

(b) Surrounding Land Use Patterns

Patterns of surrounding land use may also impose major restrictions on the types of end use possible on a given

site. For example, rehabilitating Crown land for wildlife habitat may be impractical in an area where surrounding land uses are primarily industrial or commercial. As is the case when considering site characteristics, certain uses may be seen to be most suitable when surrounding land use patterns are considered.

(c) Zoning

Municipal and Regional government zoning will, in many instances, influence what uses may be made of a given parcel of Crown land.

(d) Referral Responses

In accordance with Ministry policy, applications for Crown land tenure are referred to other government agencies. In responding, these agencies may recommend end uses for the development site. These comments may prove useful, when combined with other information, in establishing a preferred end use.

(e) Provincial Agency Planning Projects

Ministry of Lands, Parks and Housing Crown Land plans and other agency plans and reports should be considered in the determination of the appropriate end use. These plans may be either in place or in preparation.

(f) Other Statutory Regulations

Statutory regulations, especially those governing Provincial Forests, Agricultural Land Reserves and Federal and Provincial Parks, should be considered in determination of the most suitable end use.

Decisions regarding the appropriate end use should be made early in the rehabilitation planning process, as development activities can be tailored to some degree for compatibility with a given end use. Reclamation activities and timing will vary substantially with the approved end use. For example, if forest production is the approved end use of the site, seedlings of merchantable tree species may be planted in addition to seeding for erosion control and soil enhancement. Wildlife habitat would be provided for by the planting and seeding of suitable types of forage vegetation. Further residential or commercial uses, on the other hand, might require little more than filling, levelling and planting with a temporary crop of grasses to minimize erosion.

2.2 Clearing and Disposal of Vegetation

This section is applicable to any climatic regime. Areas characterized by high precipitation, steep slopes and easily erodible soils will be particularly sensitive to vegetation removal and should be treated accordingly.

2.2.1 Removal of vegetation should be kept to the minimum necessary for the proposed development. In many instances, maintenance of areas of natural vegetation will minimize the environmental impacts of the proposed development. These areas of natural vegetation will act as sediment traps and/or windbreaks and will preserve the soil for later revegetation. Retention of the maximum amount of native vegetation possible will also assist final revegetation by providing a seed source.

2.2.2 All slash and other debris should be removed by burning, burying or other acceptable means which are compatible with the proposed end use. Chipping or mulching of slash may be employed to enhance revegetation by improving soil structure and nutrient content, reducing erosion, and retaining moisture for young seedlings.

2.2.3 No clearing of vegetation should take place within 30 metres of any water body. Where this guideline proves to be impractical, trees should not be felled into or across any water body, nor should slash or other debris be allowed to enter the water.

Machinery should not be operated within a water body unless the appropriate provincial and/or federal authority has approved such work. Where any timber is to be cut, a Licence to Cut must be obtained from the Ministry of Forests.

2.2.4 In areas where soils may be easily compacted or eroded, cutting and clearing (preferably by hand) should take place, if possible, during periods when soils are frozen.

2.3 Removal, Storage and Disposal of Topsoil and Overburden

This activity should only be undertaken when required for the proposed development. Methods to be used should take into account the degree to which material to be removed may be subject to erosion, the proximity and nature of watercourses, and the climate of the development site. Where the potential for serious erosion exists, particular care must be taken to minimize the loss of soil and to prevent silt from entering watercourses.

2.3.1 Topsoil and/or overburden should be stripped from all areas where vegetation has been removed. Unless the proposed end use will not require this topsoil layer to be replaced, these materials should be

stockpiled separately in level locations at least 50 metres from water bodies, for use during revegetation.

If topsoil or overburden cannot be removed, drainage bars, diversion ditches and settling ponds should be employed to minimize soil loss and sedimentation. This will be of particular concern in regions of high precipitation. These techniques will also prove useful in reducing siltation from topsoil and overburden stockpiles.

2.3.2 Topsoil and overburden stockpiles should be stabilized as soon as possible by seeding with a rapidly growing "nurse crop" of grasses and legumes. Erosion will be minimized, the growth of weed species retarded, soil texture preserved, and the survival and growth of beneficial soil organisms enhanced by this technique. In this, as in other instances where seeding is carried out, only certified seed should be used.

2.4 Operational Site Maintenance and Rehabilitation

Site recovery may be accelerated by ongoing maintenance and rehabilitation activities. The nature and feasibility of

this work will vary with the type of activity to be carried out, the desired end use, and climatic considerations. Operations which will be occurring for a period in excess of one year should include, where applicable, such activities as ongoing removal of scrap or waste material and seeding of roadsides, berms and other unused or vacated areas.

2.5 Removal of Structures and Waste Materials

Climatic conditions should be considered in the timing of these operations. Where removal of structures will leave large expanses of bare soil, these activities should not be carried out during periods of high precipitation and/or high runoff.

2.5.1 Following completion of operations, buildings and other structures should be dismantled unless:

1) they are required for the approved end use; or
2) their removal will result in a major disruption of the site or the surrounding area. Where buildings are removed, foundations should also be removed or buried. Where the removal of fill material will have a major impact (i.e. where shorezone areas have been filled), such fill should be left in place. Scrap and refuse should be removed, burned or buried.

Excavations such as sump pits, cellars, wells, etc. should be filled unless required for the approved end use. All decisions regarding retention of structures should be made in consultation with the Ministry.

2.5.2 High volume waste materials, including waste rock, and industrial refuse, should be disposed of in such a manner and location as to minimize adverse impacts on surface runoff and groundwater. Topdressing with soil may be necessary. Waste oils, greases and non-toxic organic materials should be removed or incinerated. Construction materials and derelict machinery should also be removed. Toxic wastes should be dealt with in accordance with Ministry of Environment regulations.

2.6 Site Recontouring, Topdressing and Cultivation

These activities should not be carried out in times of high precipitation and/or runoff. Safeguards may be needed, especially in areas of high year-round precipitation, to prevent excessive soil loss and consequent sedimentation of nearby waterbodies.

2.6.1 All major excavations should be filled and/or recontoured to conform as nearly as possible to the previous landscape, except where this is not required for the chosen end use of the site. All slopes should be less than 27 degrees to promote revegetation. Where major excavations in solid rock have occurred, the creation of high angle rock faces maybe acceptable. All recontouring should allow for soil subsidence and erosion control.

2.6.2 Areas from which soil and overburden have been removed should be topdressed with a layer of overburden, followed by a layer of soil, unless this is unnecessary for the chosen end use of the site. Where soil only has been removed, replacement of overburden is unnecessary. The soil layer should be at least equal in depth to that removed prior to development. Where the approved end use is agriculture, soil depth should be sufficient to support sustained crop production. Where potentially harmful wastes have been buried, the layer of overburden used must be sufficiently deep and coarse to inhibit upward movement of water to the root zone. A base layer of crushed rock beneath the overburden may be necessary in such instances.

2.6.3 All roadways and other heavily compacted areas not intended for continued use should be ripped to a depth of approximately 60 cm prior to topdressing to promote water percolation and root growth.

2.6.4 Following topdressing, all sites should be lightly harrowed to promote water retention and thus encourage seed germination and plant growth.

2.7 Revegetation and Fertilization

Revegetation is an important aspect of rehabilitation. When properly carried out it greatly reduces erosion, sedimentation of nearby water courses, and dust production. It also promotes the recovery of soil fertility and accelerates the establishment of natural vegetation.

Timing of revegetation and choice of species should be decided on a site specific basis to maximize seedling survival and should be compatible with the proposed end use. The period between topdressing or clearing the site and seeding/planting should be minimized to reduce erosion.

2.7.1 Dominant plant species growing on the site should be identified prior to clearing. The use of these or species with similar ecological requirements for

revegetation may accelerate rehabilitation, as a result of their previous adaptation to the development area. Where practical, collection of seeds and cuttings from the development site should be carried out prior to or during vegetation removal. This will be useful when native species are to be used for rehabilitation, as seeds or cuttings of most native species are difficult to obtain commercially.

2.7.2 Prior to revegetation, the soil or overburden should be analyzed to determine the appropriate plant species to be used, the need for fertilization and type of fertilizer to be used.

2.7.3 As soon as possible after termination of activities, disturbed areas should be seeded and/or planted using the species and methods most appropriate to the site and its approved end use. Topdressing may be necessary prior to revegetation.

2.7.4 Species used for revegetation should include at least one nitrogen fixer (e.g. alsike, sweet clover, alfalfa, red clover, bird's foot trefoil, milkvetch, lupine, alder) to accelerate soil rehabilitation.

2.7.5 Seeding rate should not be less than 75 kg of seed/hectare for areas of high precipitation and should not fall below 25 kg/hectare even in arid environments. Seeding techniques will vary with the size of the area to be rehabilitated. Hand seeding will be appropriate for small or inaccessible areas while hydro seeding, aerial seeding and drill seeding will each be useful in specific situations.

2.7.6 As a general guideline, planting density for commercial tree species should not be less than 750 established seedling trees per hectare. Non-commercial species (i.e. alder, willow, etc.) should be planted at greater density. These densities may be altered to conform with site specific recommendations by the Ministry of Forests. To ensure optimal growth, tree species native to the development area should be used.

2.7.7 Fertilization should be carried out at the time of revegetation using the type and quantity determined by soil or overburden analysis. Minimum fertilization rate should be 150 kg per hectare, with somewhat greater amounts or slow release types used in areas of high precipitation. Lower rates may be acceptable if re-fertilization is necessary.

2.7.8 Mulching, where necessary, should be carried out with revegetation to maintain soil moisture, foster seed germination and promote seedling survival. This technique may prove especially useful in arid climates and on south facing slopes.

2.8 Monitoring

All rehabilitated areas should be monitored by the tenure holder for a minimum of one full growing season to determine the success of rehabilitation measures. Results of monitoring should be reported to the Ministry. Retreatment, especially seeding, planting and fertilization should be required where the initial treatment has proven unsuccessful. This should be followed by a further year of monitoring.

3.0 SELECTED REFERENCES

The references listed below, although primarily oriented towards mining, should prove useful in the provision of further information which might be needed in rehabilitation.

Carr, W.W. 1980. A Handbook for Forest Roadside Erosion Control in British Columbia. B.C. Ministry of Forests, Land Management Report 4.

Energy, Mines and Petroleum Resources, B.C. Ministry of 1981. Guidelines for Coal Exploration. Queen's Printers, Victoria, B.C.

Hackett, B., ed. 1976. Landscape Reclamation Practices. IPC Science and Technology Press, England.

Hocking, D., and W.R. MacDonald, eds. 1974. Proceedings of the Workshop on Reclamation of Disturbed Lands in Alberta, Canada, Forest Service, Report NOR-X-116.

Michaud, L.H. 1981. A Manual of Reclamation Practice. International Academic Services Ltd., Kingston, Ontario.

Schuller, F. W. and P. Sutton, eds. 1978. Reclamation of Drastically Disturbed Lands. The American Society of Agronomy.

Stephenson, H.G. 1971. User Guide to Vegetation - Mining and Reclamation in the West. U.S.D.A., Forest Service, General Technical Information Report INT-64.